CERTIFIED ECONOMIC ANALYSIS MODEL FOR USAF UTILITIES PRIVATIZATION

Version 5.5.3

USER'S MANUAL

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July 2004

Contents

Appendices

Chapter 1

Introduction

The Certified Economic Analysis Model for USAF Utilities Privatization (CEA Model) was developed by the Air Force for comparing life-cycle costs (LCC) of utilities privatization proposals against those for continued Air Force ownership and operation. The model was developed to comply with the following analytical requirements:

- Legislation authorizing DOD utilities privatization: Title 10 of United States Code, Section 2688 (10 USC 2688)
- Revised Guidance for the Utilities Privatization Program, Deputy Secretary of Defense, October 9, 2002
- Air Force Utilities Privatization Policy and Guidance Manual (December 2002)
- Office of Management and Budget (OMB) Circular A-94
- Air Force Publications AFI65-501 and AFM65-506

The Office of the Secretary of Defense requires that each branch of service use the OSD cost model or "a comparable cost model to conduct the required life-cycle cost analysis." The CEA Model is a cost model that is comparable to the OSD model.

This manual supports Version 5.4 of the CEA Model released, Nov 2003.

CEA Model user support is available from the following sources:

- Thomas Burns [(850) 283-6263 or DSN 523-6263] or Edward Page [(850) 283-6345 or DSN 523-6345] at the HQ Air Force Civil Engineer Support Agency (AFCESA)

It is recommended that the CEA Model be run on a computer with a Pentium III processor and 128 MB of RAM. The model runs on a Microsoft Excel platform. Excel 97 or later versions must be used. The CEA Model conducts analysis that would normally be input and evaluated in ECONPACK (an economic analysis model suggested for use in AFM65-506). Output from the CEA Model has been formatted to look similar to that of ECONPACK.

The primary function of the CEA Model is to project cash flows of Air Force costs under privatization and under the continuation of the status quo with Air Force ownership and operation. Through calculation of the present value of each of these respective cash flows, the LCC of the two alternatives can be compared. From this cost comparison, it can be determined whether privatization will reduce the federal government's long-term costs as required by 10 USC 2688. If the benefits of privatization are defined to be the avoidance of status quo costs, the CEA Model also provides a basis for calculating a cost/benefit ratio. However, the model does not provide for analysis of non-monetary costs and benefits.

Chapter 2

Model Structure

Overview

The CEA Model compares the LCC for a given utility under the status quo to those costs under privatization. It makes this comparison for only one privatization bid at a time.

The analysis follows the general approach shown in Figure 2-1. As this figure shows, the cash flow for the status quo alternative is developed by projecting operating costs and capital costs in terms of renewals and replacements and capital upgrades. Capital upgrades include those additions required to eliminate any existing or projected system deficiencies that could not be remedied through normal renewals and replacements.

The cash flow for the privatization alternative is calculated by projecting payments to the privatization contractor and additional costs the Air Force will incur with privatization. These additional costs include those for operational transition to a new owner, oversight of the contractor's activities, and mitigation of any negative impacts that might result from the privatization.

As Figure 2-1 shows, the CEA Model compares the life cycle costs of the alternative cash flows and provides sensitivity analysis. The sensitivity analysis measures how analytical results are affected by changed values of given inputs to reflect uncertainty implicit to those inputs.

Figure 2-2 shows a CEA Model flow chart. Numbers shown in various flow chart boxes reflect the table numbers of model output. Table 1, shown on the right-hand side of Figure 2-2, is the summary report for the analysis. The analysis begins with Table 2, General Assumptions. Inputs to this section frame the analysis by defining basic information and assumptions that are used throughout the model.

Table 3 is the operating cost for the status quo alternative. As Figure 2-2 shows, this is an input table that tracks costs from the Government Cost Estimate (GCE) Model. That model has been developed as a companion model for use in utilities privatization analysis.

Table 4 is a system inventory table. As Figure 2-2 shows, this table draws information from the Unit Cost Database embedded as a separate worksheet in the CEA Model. The Unit Cost Database is a tool that is used to establish the value of individual inventory items. Data developed in Table 4 are used as inputs to other tables. System value benchmarks are calculated and exported directly to the summary in Table 1, and data on individual system components are exported to Table 5.

Figure 2-1: Approach

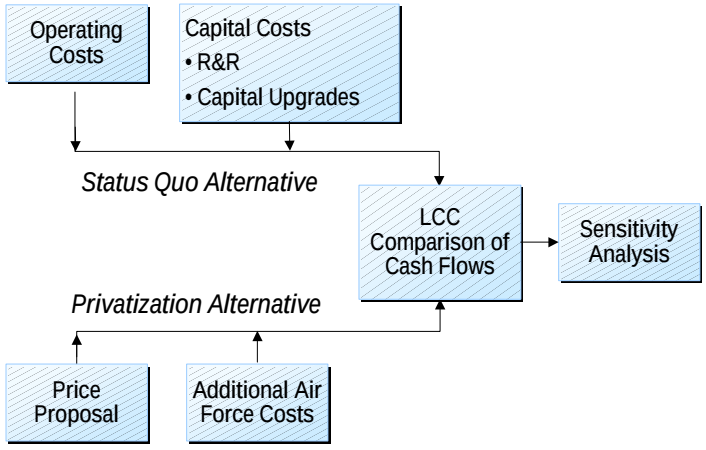

Figure 2-2. Model Structure

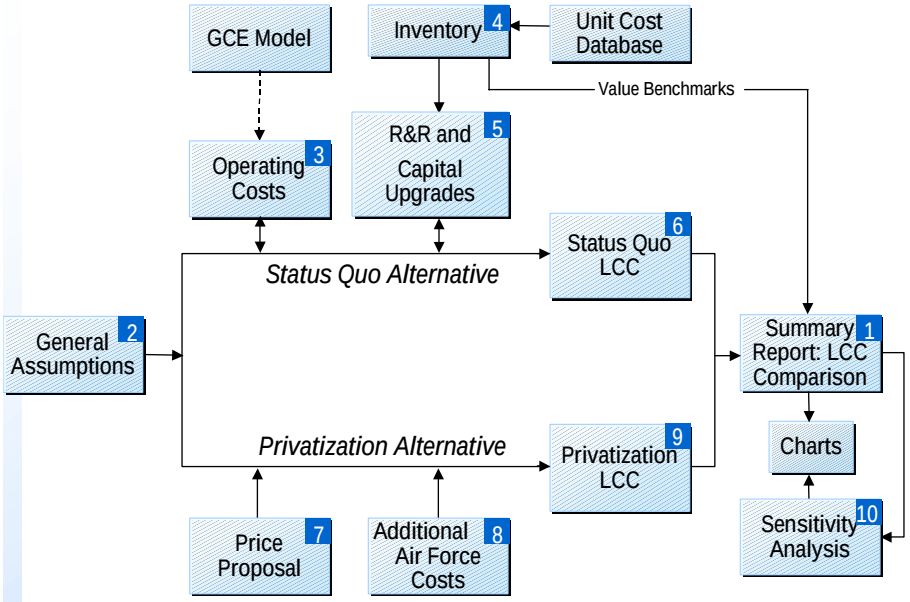

Table 5 is a schedule of future capital costs. These capital costs include those required for renewals and replacements of existing system components and for capital upgrades added to the system.

Operating costs from Table 3 and capital costs from Table 5 are used to develop a cash flow analysis in Table 6. The present value of the cash flow is also calculated in Table 6.

Data from the privatization offerors price proposal are input in Table 7 for a standard proposal following the bid schedule of the CEA Model. Alternative proposal data are input in Tables 9.1 and 9.2. Additional Air Force costs to transition, oversee, and mitigate impacts associated with privatization are input in Table 8.

Based on inputs made in Table 7, 8, 9.1, and 9.2 cash flows are projected in Table 9. The present value of the privatization cash flow is calculated in Table 9. The present value of the privatization cash flow is compared to that of the status quo in Table 1.

In Table 10, sensitivity of analytical results shown in Table 1 is evaluated based on variations in model input to reflect uncertainty.

Locked and Unlocked Model Components

With the exception of Tables 4, 5, 9.1, 9.2 and tab "Extra Worksheet", the structure of the model cannot be changed and is therefore referred to as being "locked." Changes to these locked components are restricted to input values only. The integrity and quality control of these components is therefore maintained.

Tables 4, 5, 9.1, 9.2, and tab "Extra Worksheet" are "unlocked" in that any cell within these two tables can be revised. This feature compromises built-in quality control in favor of accommodating unique input requirements that may be required for individual utility systems. While this feature provides needed flexibility, it also creates risks of disabling the model. Methods to manage this risk are presented in Chapter 3 of this manual.

The unlocked tables together with the unit cost tables are relatively data intensive. To assist the user in managing these data, a number of tools are included in the CEA Model. These are included in an "AirForce_Menu" shown in the toolbar.

Air Force_Menu

To assist in organizing the data in the Unit Cost Database and in Tables 4, 5, and 9.2 an "AirForce_Menu" toolbar was created. Clicking on the "AirForce_Menu" button on the toolbar will display a dropdown menu. Commands within the dropdown menu are described below.

- **Reset Selection To Formula From Conditional Formatting**: In Tables 4, 5, and 9.2 this selection restores the original formula in the selected cell if the user has overwritten the formula.
- **Inventory_Hide**: In Table 4, hides **Rows 24-502** when the quantity in **Column C** is zero.

- **Inventory_Unhide**: In Table 4, unhides all rows.
- **RR_Hide**: In Table 5, hides rows and columns when quantity in **Column C** is zero and when the value in **Cells K553: BH553** is equal to zero.
- **RR_Unhide**: In Table 5, unhides all rows and columns in the table.
- **Display_UnitCost_Database**: Displays the entire unit cost database.
- **Display_UnitCost_Electric**: Displays electrical system items in **Rows 4-1002** (Database Items 1 – 999) and all user inputted items in **Rows 1003-1503** (Database Items 1000-1500).
- **Display_UnitCost_Gas**: Displays natural gas system items in **Rows 4-1002** (Database Items 1 – 999) and all user inputted items in **Rows 1003-1503** (Database Items 1000-1500).
- **Display_UnitCost_Water**: Displays water system items in **Rows 4-1002** (Database Items 1 – 999) and all user inputted items in **Rows1003-1503** (Database Items 1000 – 1500).
- **Display_UnitCost_WW**: Displays wastewater system items in **Rows 4-1002**(Database Items 1 – 999) and all user inputted items in **Rows 1003-1503** (Database Items 1000 – 1500).
- **Display_UnitCost_Used**: Displays only Unit Cost items used in the Status Quo Inventory. Allows easy printing/extraction of only the items used in the estimate for inclusion in the CEA report. Select "Display_UnitCost_Database" to show all items.

The dropdown menu items are described in more detail in Chapter 3.

Required Input

In order to produce accurate analysis, it is necessary to complete essentially all input fields to the CEA Model. The exceptions are in Tables 4, 5, 9.1, 9.2, and the Unit Cost Database. In Tables 4 and 5 and the Unit Cost Database, significant extra space is provided for inventory and cost data; in Tables 9.1 and 9.2 input is required only if the proposal to the RFP uses an alternative bid format.

Input sections to the model are shown in blue font. In the locked components of the model, input sections also have a light aqua-blue background.

The table numbers in the upper left area of each numbered table are formatted as inputs. This allows the user to renumber the tables as may be required for inclusion in other reports.

Documentation

Since the CEA Model has Excel as its platform, it is self-documenting. The formula for each calculation is shown in the formula bar at the top of each worksheet.

Chapter 3

Table Descriptions and Input Requirements

In this chapter, each of the tables outlined in Chapter 2 is described and their input requirements are identified. The order of presentation follows the flow chart in Figure 2-2. As a result, Table 1, the summary report to the analysis, is presented after Table 9. Otherwise, presentations of the tables follow in numerical order.

The descriptions that follow are intended to facilitate use of the model and clarify input requirements. This manual is not intended to instruct on how inputs are derived or how analysis is to be conducted. The manual is best used with the CEA Model opened and available for on-screen reference.

As described in Chapter 2, Tables 4 and 5 are unlocked. In order for the model to calculate results accurately, 2 rules must be followed:

1. **Rows, columns, and cells may not be added to or deleted from the worksheet.**
2. **Rows, columns, and cells may not be CUT and pasted into other areas of the worksheet. The COPY and paste function will not affect calculations.**

Doing any of the actions above will affect other calculations in the model and lead to inaccurate results.

Table 2 – General Inputs and Assumptions

Table 2 includes two pages. The first page requires a variety of general inputs while the second page requires input for both historic and projected price inflation.

Table 2, Page 1

Table 2, Page 1, can be found by clicking on the "T2a-Gen Inputs" tab.

Rows 7 through 9 of this table simply identify the Air Force base, the utility system under study, and the name of the Offeror whose bid is being evaluated. **Row 8** is a pick list of the various types of systems. Pick "Other" if the type of system being privatized is not on the list.

Row 10 requires input to answer the question "Is this a firm that pays federal income taxes?" The reason for this edit is that both privately owned and publicly owned utilities may have federal income taxes included in their bid even though they are not allowed by the Federal Acquisition Regulations (FAR). **Row 11** shows the OMB Circular A-76 Supplemental Tax Rate that will be used in the model if the Offeror pays federal income taxes. N/A is displayed if **Row 10** input is not a "Y". If the Utility System selected is "Other" (**Row 8**) and the Offeror pays federal taxes (**Row 10** = "Y"), enter the appropriate Federal Tax Rate from the A-76 Supplemental in **Column O, Row 11**.

The estimated amount of federal income tax paid in the projected cash flow is credited to the privatization alternative for evaluation purposes (see **Table 9**). The reason for this credit is to satisfy the current OSD guidance and 2688 requirements to evaluate the cost to the US Government. However, federal taxes are not allowed as expenses on federal contracts that follow FAR 31. This conflict of requirements is under review.

The model uses federal tax rates from OMB Circular A-76, Revised Supplemental Guidance, Appendix 4 – Tax Tables available at: http://www.whitehouse.gov/omb/circulars/a076supp.pdf The user is required to input the Tax Rate if the utility system is "Other".

Row 12 requires input as to the first year that the utility would be operated as a privatized entity.

Row 13 requires input as to the Study Period, i.e., the length of the analysis in years. The analysis period must be between 2 and 50 years. After the user inputs the length of the analysis period, charts Cuml PV and Cuml R&R and tables in worksheets "T1A- Comp", "T6-LCC-SQ", "T9- LCC-Pr." will automatically update to reflect the selected length of the study period.

Based on information in Rows 12 and 13, the study period years are defined as shown in **Rows 14 and 15**.

Values for **Rows 16 and 17** are determined by input in cells **O12 and O13** in the worksheet "T3- SQ Op Inp".

Row 18 reports the year of the unit cost data included in the Unit Cost Database. No input is required in this row.

Rows 20 and 21 require input as to whether the cash flow projections are to be calculated in either "real" or "nominal" terms. A "real" cash flow projection is based on constant price levels. In the CEA Model, the real cash flows would be projected based on price levels in the first year of privatization. A nominal cash flow would include projected price inflation. Air Force guidance is for projections to be made in real terms.

Rows 23 and 24 require input of discount rates used to calculate the present value of projected cash flows. The real discount rate is input in **Row 23,** and the nominal discount rate is input in **Row 24** for the length of the study period**.** These rates must be taken from the current version of Appendix C to OMB Circular A-94, available at: http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html. In **Row 25**, the appropriate discount rate is selected based on whether real or nominal cash flow projections are selected in **Rows 20 and 21**.

Rows 27 through 29 allow selection of optional discounting methods, in terms of beginning-of-year, end-of-year, or middle-of-year conventions. AFM 65-506 recommends that a middle-of-year convention be employed. Select only one convention.

Rows 32 through 34 require input as to whether any materials and supplies, tools, and special equipment will be retained by the government. Materials and supplies include "plant held for future use." If they are to be retained, a "Y" should be placed in the associated input cell; and if they are not to be retained, an "N" should be placed in the input

cell. ”Y” entries set the row descriptions in Table 8 where values for these line items are entered.

Rows 37 through 44 identify whether there are other direct Air Force costs associated with privatization. In almost all circumstances, the Air Force will incur additional costs for contractor oversight, transition, and recurring contract renegotiations. To indicate that these costs will be incurred, place an “X” in the appropriate input cells in **Rows 37 though 39**. **Rows 40 through 44** are provided to specify any other additional direct costs the Air Force might incur with privatization. If additional direct costs are listed, it is necessary to also include an “X” in **Column G**. Entries in these cells set the row descriptions in Table 8 where values for these line items are entered.

Rows 46 through 52 identify whether there are any indirect costs associated with privatization. These indirect costs could include training or an increase in the cost of commodity supply associated with the privatization. If either of these apply, an ”X” should be placed in the appropriate input cell (**Cells G46 or G47**). Typically, training would include special training that the Air Force would need to add due to the loss of training that otherwise would occur with the status quo. Space is provided for input of other indirect costs in **Rows 48 through 52**. If additional indirect costs are listed, it is necessary to also include an “X” in **Column G**. Entries in these cells set the row descriptions in Table 8 where values for these line items are entered.

Table 2, Page 2

Table 2, Page 2 can be found by clicking on the “T2b-Inf Index” tab.

Inflation indexes are to be input in **Column I** of this worksheet. The source of these data should be the most current Budget of the United States Government. This source is available at http://www.gpoaccess.gov/usbudget/fy05/sheets/hist10z1.xls (change fy05 to the current years budget). The fiscal year of this budget must be input in **Cell J6**. The table number from the budget must be input in **Cell I7**.

Currently, inflation data are provided in Table 10.1 (GDP (Chained) Price Index column) of the Budget. This source will include a 5-year inflation projection. However, **Column I** requires inflation index inputs through 2061. Projections beyond the Budget’s 5-year inflation forecast must be made by extrapolating the rate of change in the last year of the Budget’s forecast to all future years through 2061. We ignore the index factor for the Temporary Quarter (TQ) between FY76 and 77.

Table 3 – Annual Operating Costs for the Status Quo Alternative

Table 3 can be found by clicking on the “T3-SQ Op Inp” tab.

As noted above, this table takes basic input from the GCE Model. Data from this source can be input to this tab in **Column O Rows 12 through 55** by reference, or by simply copying (copy then paste special – values) the data from the GCE Model, or by manual entry.

If the housing utility system is being privatized through a separate effort, then the utility system O&M costs need to be allocated between the base and housing. The models can accommodate two methods for separating the housing O&M from the main base. The first

method is to allocate the O&M costs using the replacement cost new of the utility system for the portion of the base being privatized in this effort versus the replacement cost new for the entire base. The inventory for the portion of the base being privatized in this effort is entered in tab T4- Inventory in **Rows 24 - 502** and the remaining inventory for the base is entered in **Rows 530 – 729**. The second method is to allocate the O&M cost based on consumption. This is accomplished in the GCE Model CEA Model Input tab.

Table 3 inflates the cost data input from the GCE Model from the base year of data from the GCE Model to the first year of privatization.

The Area Cost Factor from the GCE Model is automatically input in **Row 16 of Table 2** and the base year of data from the GCE Model is automatically input in **Row 17 of Table 2**.

Final Insurance calculations are performed in this tab in **Column W**. The user should modify the Capital Upgrades book value if the capital upgrades partially or fully replace part of the existing system. The model defaults to 50% of the Replacement Cost New of all Capital Upgrades as the average book value of the components. However, if some of the capital upgrade will replace some or all of the existing components, then the user must adjust this cost to reflect 50% of the net change to the overall Replacement Cost New when these upgrades are implemented.

Unit Cost Database

The Unit Cost Database is found by clicking on the "Unit Cost" tab.

The Unit Cost Database provides data on the unit cost and the design life for 999 components of electric, natural gas, water and wastewater utility system construction. Each inventory item is assigned an index number between 1-1800 (**Rows 4-1803**). Index numbers 1-999 (**Rows 4-1002**) are assigned to inventory items in the database that will be consistent among all users of the model. Index numbers 1000-1800 (**Rows 1003-1803**) are available for the user to include additional inventory/construction components unique to their specific utility system.

The index numbers are used in Table 4 to identify which item to use from the Unit Cost Database to develop the value of the utility system's inventory. The user inputs the index numbers that describe the existing and replacement components with their trenching components in **Columns E, G, I, and K** in the "T4- Inventory" worksheet. Please see discussion of Table 4 -Inventory below for further instructions.

Refer to the Utilities Privatization Database Overview in Appendix A to this manual on more specific information on how to use this database.

The Unit Cost Database can be abridged to show data pertinent only to the type of utility system under study or just the items used in the "T4-Inventory" Table. This can be done by clicking on "AirForce_Menu" in the toolbar at the top of the screen. A dropdown menu is produced. The last six items in that dropdown menu read:

Display_UnitCost_Database
Display_UnitCost_Electric
Display_UnitCost_Gas
Display_UnitCost_Water
Display_UnitCost_WW
Display_UnitCost_Used

Clicking on "Display_UnitCost_Database" will show the entire database. Clicking on "Display_UnitCost_Used" will show all selected items from the database on Table 4 "T4-Inventory". However, clicking on each of the other four menu items will display data only for the one utility system specified in the menu item. For example, clicking on "Display_UnitCost_Electric" will display database information only for electric utility components; data for other utility systems will be hidden.

It is important to understand that this database does not include all components of the various utility systems. It is limited to major common components. System components not included in the database must be input in **Rows 1003 through 1803** (these rows correspond to Index Nos. 1000 through 1800 shown in **Column A**). Index numbers and their purposes are described more in detail below.

An extra 298 line items have been developed that are approved for use without any additional justification. These items are available from HQ AFCESA/CESC.

When adding new components to the Unit Cost Database, **Columns D, E, F, G, H, I, and J** must be completed as a minimum. Unit cost data for new components, input to the Unit Cost Database in **Column H**, must be in terms of the same base year as shown in **Cell C1**. These data must also be input at base national averages consistent with R. S. MEANS total cost including Overhead and Profit for the installing contractor. This is because the overall cost estimate is adjusted to include general conditions; contingency; Supervision, Inspection, and Overhead (SIOH); design; and to local cost levels through application of specific factors as discussed below under "Table 4-Inventory." If an item is added that is not from a nationally recognized source or it is a derivation from a nationally recognized source, then show how the cost was developed in the "Extra Worksheet" tab.

Table 4 – Inventory

The system inventory can be found by clicking on the "T4-Inventory" tab.

This worksheet is unlocked. Cells can be overwritten and analyses added in empty portions of the worksheet. However, as noted above**, it is vital that the users not add, delete, or cut rows, columns and cells in this worksheet.** Doing so will affect other calculations in the model.

Other than adding/deleting/cutting rows, columns, or cells, the CEA Model provides some security against erasing portions of worksheets that ultimately may be needed. The model leaves "electronic breadcrumbs" that identify where original formulas have been erased or overwritten. These breadcrumbs also allow the user to restore the original formula(s). When a cell that is not reserved for input is erased or overwritten, it is marked with a gray

background. If the user decides that the original cell should be restored, it can be accomplished through use of the AirForce_Menu in the toolbar. Highlight the cell for which the original formula is to be restored. Then, click on AirForce_Menu to produce a drop-down menu. Click on the first menu item, "Reset Selection To Formula From Conditional Formatting." The original formula will be restored to the highlighted cell.

The purpose of Table 4 is to develop an inventory, establish alternative value estimates for the inventory, and determine the remaining life of each inventory component. Value estimates in Table 4 include replacement cost new (RCN), replacement cost new less depreciation (RCNLD), and original cost less depreciation (OCLD).

The RCN value is used as a basis for projecting the future cost of renewals and replacements of system components. The RCNLD and OCLD values are used as benchmarks for system market value. The remaining life of each component is needed to estimate the timing for future renewals and replacements.

Eleven user notes are provided at the top of the table. These user notes describe how data are to be input in Table 4. They are repeated here:

1) All cells in Blue Font require inputs from the user.

2) Input the Inventory Component **(Column A),** Size **(Column B),** Quantity **(Column C)**, and Unit **(Column D)** of each inventory component. The Unit input should be the parameter for measuring the quantity (e.g. linear feet or "each" for number of units of a given component).

3) Input in **Column E** the Index No. from the "Unit Cost" worksheet that best describes the material for the existing inventory. This will automatically populate the unit cost in **Column M** and the design life in **Column T**. If the component is not included in the Unit Cost database, you must add the component to the unit cost database. In doing so, you must input the following minimum requirements: Item Number, Data Source, Component Description, Units of Measurement (UOM), Total Unit Cost, Design Life, and Replacement Cost Factor. The Index Number for each added unit cost must be selected from one of the unused numbers in the file ranging from 1000 to 1500.

4) If the existing component is underground, input in **Column G** the index number from the "Unit Cost" worksheet that best describes the type of trenching that would be necessary to install the existing inventory item--the unit costs will populate in **Column N** automatically. If better information is available on unit costs of trenching, you may over-ride the unit cost in **Column N** or input a new item in the data base using instructions in note #3. <u>For electrical wires, do not forget to divide the formula in column N by the number of wires</u>.

5) Input in **Column I** the Index No., from the "Unit Cost" worksheet that best describes the component and material that would be used today, even if it is the same as the existing component. This will automatically populate the unit cost in **Column P**. If the component is not included in the Unit Cost database, you must add the component to the unit cost database using instructions in note #3.

6) If the replacement component is underground, input in **Column K** the index number from the "Unit Cost" worksheet that best describes the type of trenching that would be

necessary to replace the inventory item--the unit costs will populate in **Column Q** automatically. If better information is available on unit costs of trenching, you may over-ride the unit cost in **Column Q** or input a new item in the database using instructions in note #3. For electrical wires, do not forget to divide the formula in column Q by the number of wires and add the cost for roadcuts.

7) The design life can be adjusted to reflect differences in life of components installed at different bases. This adjustment can be made in **Column U**, "Life Adjustment Factor (%)". The default adjustment factor is 100%.

8) Input approximate year of construction in **Column S**, 1940 through current year. **For years prior to 1940, enter "1940."**

9) All input columns must be filled out for each entry.

10) If there is no existing component, then input in **Column AB** the year the replacement component will be first installed. The cells to check have a green background with blue font. This cell defaults to the first year of privatization if there is no existing component.

11) **Do not insert or delete any rows or columns to this worksheet.** Doing so will change other calculations in the model.

Columns F, H, J, and L contain the full component description for each inventory item. These descriptions are generated from the Unit Cost Database based on the index numbers input in **Columns E, G, I, and K**. **Columns F, H, J, and L** can be shown or hidden by clicking on the plus or minus signs shown above the columns at the top of the worksheet. Viewing these columns allows the analyst to double check to be sure that the index number used for a system component is correct. Hiding these columns reduces the size of the worksheet.

Five hundred rows are allowed for input of components to the system inventory. Columns containing value estimates (**Columns Z, AA, AC through AG**) are subtotaled in **Row 504**. In **Rows 506 through 512**, general requirements, contingency, supervision, inspection, and overhead (SIOH), and engineering are added to compute the overall value estimate. The total value assuming base national construction costs are shown in **Row 513**. In **Row 514**, this total is adjusted for the area cost adjustment factor discussed above under "Table 2, Page 1."

Cell C510 is the SIOH percentage. The default percentage is 5.7% for the continental US. Change this to 6.5% if the project is overseas, including Alaska and Hawaii.

Clicking on "AirForce_Menu" in the toolbar can hide Rows not used to list components to the system inventory. In the dropdown menu, click on "Inventory_Hide" to hide the empty rows. To unhide those rows, click on "Inventory_Unhide."

Note: Electrical wire is input as Single Conductor Linear Feet.

Inventory items not included in the UP effort, but O&M cost is in the GCE estimate. The T4- Inventory tab has an additional section in **Rows 520 – 741** to enter the inventory items not included in the UP effort, but O&M cost is in the GCE O&M estimate. If the base is privatizing the housing system under a separate effort or the base is keeping a portion of the

system, etc. and the O&M cost for these portions of the system are included in the GCE O&M estimate; then enter these items here. The Replacement Cost New calculated in **Cell AF741** is used to allocate O&M costs between these excluded areas and he rest of the base. Instructions for inputting data into this section are the same as above (except for different row numbers).

Table 5 – Projected Renewals and Replacements, Capital Upgrades and Residual Values

Table 5 is found by clicking on the "T5-RR" tab.

This worksheet is unlocked. Cells can be overwritten and analyses added in empty portions of the worksheet. However, as noted above, **it is vital that the users not add, delete, or cut rows, columns and cells in this worksheet.** Doing so will affect other calculations in the model.

Erased or overwritten cells in this worksheet can be restored using the same procedure described for Table 4.

Renewals and Replacements

Based on inputs made in Table 4, a projected cash flow of renewals and replacements is automatically calculated in **Columns K through BH** of Table 5 and residual values in the last year of the cash flow are calculated in **Columns BI through BL**.

Each inventory component input to Table 4 is repeated in Table 5 (**Columns A through D** of Tables 4 and 5). Design life of the existing and the replacement components are shown in **Columns E and F**, respectively.

As noted in **User Note 1**:

> The renewal and replacement costs of system components will generally be greater than the RCN value estimated in the Inventory to cover removal and disposal of the existing component. This extra cost factor is automatically input in **Column H** based on the Index No. input in the Inventory worksheet. This factor can be over-ridden if better information is available.

The RCN value calculated in Table 4 for each system component is shown in **Column G** of Table 5. This value is adjusted by the factor in **Column H** to yield a renewal and replacement cost estimate shown in **Column I**. As the user note states, the adjustment factor in **Column H** is derived from **Column J** of Unit Cost Database based on the input index number for replacement component input in Table 4. **Column J** is the first year of replacement calculated from **Column AB** of Table 4.

Columns containing value estimates are subtotaled in **Row 504**. In **Rows 506 through 513**, general requirements, contingency, SIOH, and engineering are added to an overall value estimate. The total cost for renewals and replacements for each year in the cash flow are shown in **Row 513** assuming constant, base national construction costs. The area cost factor is applied in **Row 514** to yield estimated costs in the local construction market. This total amount is adjusted to current year values in **Row 515** if nominal cash flow projects were selected from Table 2, Page 1.

Capital Upgrades

Inputs are required for all capital upgrades that are necessary to remedy system deficiencies. **User Note 2** in Table 5 provides the following guidance:

> To input Capital Upgrade costs click on the menu bar "Air Force_Menu" and select "RR Unhide". Go to row 521. All cells with BLUE font require inputs from the user. Input the description of the capital upgrade in **Column A**, the size of the component in **Column B**, the quantity in **Column C**, and the unit in **Column D**. The design life is entered in **Column F**. If the project covers work that will be included in the Renewal and Replacement of an inventory item, then enter 100 years as the design life. An example would be a project to properly ground transformers. In this case, the next renewal cycle for the transformers will include proper grounding; therefore, the deficiency correction is needed only one time. Input the estimated value of the capital upgrade in **Column G**. Values and replacement factors (**Column H**) for capital upgrades must be calculated outside of the model. In making these estimates, exclude general requirements, contingency, SIOH, and engineering. These costs will be added at the bottom of this worksheet. For the first seven years contingencies are set to 5% assuming all capital upgrades in these years are new construction. From years 8 through the end of the study period, contingencies are set to 10% assuming for these years these projects are in a renewal and replacement state. The user can change these calculations, if necessary. If the year of investment is planned to be different from the first year of privatization, you may overwrite the year shown in **Column J**.

These capital upgrades must be input in the space provided in **Rows 521 through 541**. Inputs of capital upgrades must exclude any renewals and replacements; they must be to correct deficiencies or meet new regulatory requirements. One example of capital upgrades for input in **Rows 521-541** is a crossover water line connection made to increase fire flows to levels required by the Fire Marshall. Another example is to properly ground transformers that do not meet industry code requirements.

As an alternative, capital upgrades may be entered in Table 4 if you want to use the Unit Cost database to cost the capital upgrade. Enter a 0 for the existing component and existing trenching. Enter the new component and any trenching required under the replacement columns. Then enter the year it will be installed in **Column AB**. This is a good method to use for adding simple components such as new meters.

The residual value for each component in the last year of the analysis period is shown in **Column BI**. This value is in terms of constant year dollars. Using factors in **Columns BJ and BK**, the residual value for renewals and replacements and capital upgrades is calculated in

current year dollars. The results of this calculation are shown in **Column BL**. The current year value is provided in terms of costs in the year of construction.

Columns containing value estimates are subtotaled in **Row 543**. In **Rows 545 through 552**, general requirements, contingency, SIOH, and engineering are added to an overall value estimate. The total cost for capital upgrades for each year in the cash flow (**Columns K through BH**) are shown in **Row 552** assuming constant, base national construction costs. The area cost factor is applied in **Row 553** to yield estimated costs in the local construction market. This total amount is adjusted to current year values in **Row 554** if nominal cash flow projects were selected from Table 2, Page 1.

In conducting analysis and reviewing output from Table 5, it is sometimes necessary to view all rows and columns of the worksheet and sometimes it is desirable to view only those rows and columns that contain data. To toggle between these two views, click on the AirForce_Menu in the toolbar and, from the drop-down menu, select "RR_Unhide" to view all rows and columns; select "RR_Hide" to view only those rows and columns that contain data.

Table 6 – Life-Cycle Cost Analysis Report for the Status Quo Alternative

Table 6 can be found by clicking on the "T6-LCC-SQ" tab.

No user inputs are required for Table 6. Based on data developed in Tables 3 and 5, a projected cash flow for the status quo alternative is generated in Table 6. Operation and maintenance and general and administrative costs for the first privatization year are transferred from Table 3 to **Cells B15** and **C15** respectively. These amounts are projected to stay constant in real terms but increase in nominal terms according to projected inflation.

The renewal and replacement cash flow shown in **Row 515** in Table 5 is transferred to **Column D** of Table 6. The capital upgrade cash flow shown in **Row 554** in Table 5 is transferred to **Column E** of Table 6.

As shown in the last row of Table 6, the residual value of renewal and replacement and capital upgrade investments made over the study period are included as a credit (or a negative cost) at the end of the cash flow.

Cash flows shown in **Columns B, C, D, and E** are summed to a total cash flow shown in **Column F**. The present value of the cash flow is calculated in **Columns G through I**. As shown in the last row, the present value of the cash flow is reduced by the residual value.

Table 7 - Privatization Price Proposal

Table 7 is found by clicking on the "T7-Priv Inp" tab. This table is used to enter bid information in the standard format specified in the RFP. If the proposal is not in the standard format, use "Table 9a- Projects" to enter the bid information.

Input to **Row 13,** "1. Purchase Price Payment Credit less Recovery Portion" comes directly from CLIN AA, Schedule B-2 of the proposal. It is assumed that this amount will begin in

the first month of privatization. Since this should be either a zero or a negative number, enter the monthly amount as a negative number in **Column F**. Enter the number of months in **Column L**.

Input to **Row 15**, "2. Fair Market Value" comes from CLIN AA, Schedule B-2 of the proposal. This is the Purchase Price Payment Credit without interest charges. Enter the value in **Column F.**

Input to **Row 17,** "1. Operation and Maintenance" and **Row 18**, "2. Renewals and Replacements" comes from Schedule L-1 of the proposal. It is assumed that these charges will begin in the first month of privatization and apply throughout the analysis period. Enter the monthly amount in **Column F.**

Input to **Rows 21 through 50**, "4. Initial Capital Upgrades" comes from Schedule L-3 of the proposal. Monthly dollar values and timing of charges bid by the offeror are input in **Columns F, I, and K** of Table 7. The monthly charges are input in **Column F**. The proposed month that the charges would begin are input in **Column I**, and the number of months the charges will remain in effect are input in **Column K**.

Input to **Row 51** "2. Contribution in Aid of Construction Taxes (Total amount)" comes from schedule L-3 of the proposal.

Input to **Row 53** "1. Transition Costs" comes from schedule B-2. Monthly dollar values and timing of charges bid by the offeror are input in **Columns F, I, and K** of Table 7. The monthly charges are input in **Column F** from schedule B-2. It is assumed that these charges will begin in the first month of privatization. The number of months the charges will remain in effect is input in **Column K**.

Table 8 – Additional Air Force Cost

Table 8 can be found by clicking on the "T8-Priv-AF Costs" tab.

In addition to rate charges paid to the privatization contractor, the Air Force will incur additional costs with privatization. As discussed under Table 2, Page 1, and reflected in Table 8, these include direct and indirect costs. Table 8 also shows that these costs may be at least partially offset by some indirect monitory benefits.

Rows 12 through 32 show direct costs. Standard factors for the calculation of contractor oversight, operational transition, and periodic price redetermination costs are loaded in **Column F**. If these assumptions apply, no further input is required by the user.

For contractor oversight, the user may override the standard amounts (with specific justification) and input cost as a percent of Adjusted Status Quo O&M up to a maximum amount. Current OSD guidance specifies that these costs will be 5 percent of Adjusted Status Quo O&M cost up to a maximum of $100,000. These costs are projected to occur annually.

Transition costs are calculated in a similar fashion. The user may override the standard amounts and input the percentage that transition costs will be of Unadjusted Status Quo

O&M Labor cost without G&A up to a maximum amount. Currently, OSD guidance is for these transition costs to be 10 percent of Unadjusted Status Quo O&M Labor cost without G&A up to a maximum of $50,000. These costs are projected to occur only in the first year of privatization.

Consistent with Air Force guidance, the cost for price redetermination negotiations depends on the size of the given utility system. For systems with privatized O&M costs less than a certain amount, the estimated costs can be set at one level while systems with privatized O&M costs at a higher level can have the price redetermination costs set at a different level. Currently, Air Force guidance specifies that the cost for price redetermination negotiations for utility systems with privatized O&M costs of less than $100,000 will be set equal to $2,500 (FY2004$) per renegotiation. For utility systems with privatized O&M costs of greater than $100,000 Air Force guidance is for these costs to be 5.4 percent of the annual privatized O&M costs. These costs are updated automatically to the first year of the analysis.

Consistent with the standard Air Force RFP for utilities privatization, price redetermination costs are projected to occur every third year in the cash flow. There is one exception to this. The current Air Force RFP allows for the first price redetermination to occur after only 2 years. Therefore, the cash flow for price redetermination negotiations shown in **Column K** of Table 9 provides for costs to be incurred at the end of the second year followed by price redetermination costs occurring every third year thereafter.

Rows 27 through 31 show other direct costs as identified in Table 2, Page 1. The user must input dollar amounts associated with these costs in **Columns H, I, or J** depending on whether these costs are incurred only in the first year, every third year, or in all years, respectively.

Rows 34 through 40 show indirect costs. Any indirect costs identified in Table 2 will be listed in these rows. As with other direct costs, the amounts associated with each listed indirect cost should be input in **Columns H, I, or J**, depending on whether the costs occur in the first year, every third year, or in all years, respectively.

Rows 43 through 45 identify any indirect monetary benefits from privatization based on inputs made in Table 2, Page 1. Inputs in Table 2 specify whether materials and supplies, tools, and special equipment are to be retained by the government. If any of these items are not included in the sale, they are considered to be an indirect monetary benefit from privatization. This is because these items will no longer be used for utility operations. The offeror will implicitly include costs for its materials and supplies, tools, and special equipment in its bid. The Air Force can use its materials and supplies, tools, and special equipment for other purposes, or sell them separately and receive value for them as a result. This value should be input in **Column H** since the benefits will occur in the first year only.

The user should confirm that materials and supplies, tools, and special equipment items are handled consistently between the inventory, government cost estimate, and the published Request for Proposal.

Table 9 – Life-Cycle Cost for the Privatization Alternative

Table 9—Overall Cash Flow and Life-Cycle Cost Analysis

Table 9 can be found by clicking on the "T9—LCC-Pr" tab.

No inputs are required for Table 9. The table is broken into four sections: payments to the contractor (**Columns B through G**), reduction in costs to net out federal income tax payments for evaluation purposes (**Columns H and I**), additional Air Force costs (**Columns J through L**), and total cash flow/present value analysis (**Columns M through P**).

The cash flow for "Contract Items" (or payments to the contractor) shown in **Columns B through G** is calculated based on inputs made in Table 7 for a standard proposal and Tables 9.1, and 9.2 for an alternate proposal. Total project costs shown in **Column E** are the summation of cash flows associated with initial projects identified in Table 7. The detail of the cash flow for these projects is shown in Table 9.2. Table 9.2 is discussed below.

If "Nominal (for Current $)" cash flows are specified in in **Row 20** of Table 2, Page 1, the Purchase Price Credit less Recovery Portion (**Column B**), Total Project Costs (**Column E**), and Transition Cost (**Column F**) stay constant in nominal dollars since they are not subject to price redetermination. Costs associated with O&M (**Column C**) and Renewals and Replacements (**Column D**) are subject to inflation. Accordingly, the cash flow in **Columns C and D** are projected to increase according to inflation inputs. These costs are programmed to increase according to scheduled price redetermination years.

If "Real (for Constant $)" cash flows are specified in **Row 20** of Table 2, Page 1, all cash flows would be in constant, base year dollars. As a result, O&M and renewal and replacement projections would be constant. On the other hand, the Purchase Price Credit less Recovery Portion, Total Project Costs, and Transition Costs would be reduced in real terms since they are constant, current-dollar cash flows.

Federal income taxes included in the offerors bid are shown in **Column H**. This amount is based on inputs made in Table 2, Page 1 and Table 7.

Column I is equal to the total contract cost shown in **Column G** less the amount in **Column H**.

Other Air Force costs shown in **Columns J through L** are calculated based on inputs made in Table 8. These cash flows are subject to inflation.

The overall projected cash flow for the privatization alternative is shown in **Column M** with present value calculated in **Columns N, O, and P**.

Table 9.a—Projects

Table 9.1 and 9.2 can be found by clicking on the "T9a-Projects" tab.

No inputs are required if the response to the RFP is in the format specified in the RFP.

Table 9.1 allows the user to input responses to the RFP that are not in the format specified in the RFP. If required, the user may input separate annual values for Purchase Price Credit less Recovery Portion, Operations and Maintenance, Renewals and Replacements, and

Transition Costs. **Rows 67-266** are available for Alternative Proposal calculations. **Columns B and E** are input in current year dollars while **Columns C and D** are input in constant dollars. Calculations in Table 9 convert the dollars to either constant or current depending on whether Real or Nominal cash flow projections were selected in Table 2, Page 1, **Rows 20 and 21.**

Table 9.2 shows the cash flow associated with each project identified in **Rows 21 through 50** of Table 7. Annual cash flows for each project are calculated based on the monthly payments and the months payments are proposed to be made as specified in **Columns F, I, and K** of Table 7. If required, the user may input separate annual values for each project in each year in current year dollars.

Any values entered into this table override the values entered in Table 7.

Table 1—Economic Analysis Summary

Table 1—Economic Analysis Report

Table 1 can be found by clicking on the "T1-Summary" tab.

No inputs are required for Table 1. This table has three subsections. The first subsection follows the format of ECONPACK. Under "Executive Summary Report," summary input information is presented including the project title, name of the bidder, and other miscellaneous background information.

The second subsection presents the "Net Cost Analysis." It compares the present value of Air Force costs under the status quo alternative to that under the privatization alternative. Privatization savings are calculated and the ratio of the present value of status quo costs to privatization costs is calculated. If benefits of privatization are defined as the avoidance of status quo costs, this ratio is the cost/benefit ratio for privatization.

The third subsection presents value benchmarks calculated in Table 4 and the Privatized Fair Market Value from the proposal. It includes both the RCNLD and OCLD value benchmarks as the Government's estimate of the Fair Market Value of the utility system.

Table 1a—NPV Comparison

Table 1a can be found by clicking on the "T1a-Comp" tab.

No inputs are required for Table 1a. This table has two subsections. The first subsection is a comparison of the adjusted status quo and the private bid by cost category. The cost categories that are compared are Purchase Price less Recovery, O&M + GA, R&R, Capital Projects, Transition Costs, and Other costs.

The second subsection presents an annual comparison of R&R costs and Capital Project costs in constant dollars for the adjusted status quo and the private bidder.

Table 10—Sensitivity Analysis

Table 10 can be found by clicking on the "T10-Sensitivity" tab.

As noted previously, this sensitivity analysis tests the impact on study results of variations in inputs. Variations of input values are to reflect the range of uncertainty associated with the given input.

The CEA model allows analytical results to be tested based on variations in the following inputs:

- Discount Rate
- Additional Air Force Costs with Privatization
- Status Quo Operation and Maintenance Costs
- Status Quo General and Administrative Costs
- Status Quo Renewals and Replacement Costs
- Federal Income Taxes Implicit to the Privatized Bid
- Exclusion of Residual Value of Status Quo Investment in Final Year of Cash Flow

For each adjustable input, in the **top row** of the listing, a "plus and minus" percentage variation of the base case input value can be specified. The base case is defined as the value currently entered/calculated in the model. The lower bound of the sensitivity **(Column E)** should be entered as a negative percent. For instance, if user would like to see the impact of an input being 20 percent less than the base case value, -20 would be entered in **Column E**. Similarly, the user can see the impact of an input being 30 percent higher than the base case by entering 30 in the **Column G.** This general approach applies to all sensitivity inputs.

Once upper and lower bounds have been entered for the desired inputs, the sensitivity analysis can be run by simultaneously pressing the **<Ctrl> and <Q> keys.** This is required to populate the sensitivity cells and subsequent charts.

In the next row, the value of the range in input values to be tested is calculated. In the next two rows, the resulting present value of the overall status quo and of the privatization cash flows are calculated. If the least-cost option changes within the range of uncertainty, it is noted in **Column H**.

Rows 40 through 43 show the effect excluding the residual value of the status quo investment in the final year of the cash flow. No input is required.

Sensitivity Analysis Using the Tchebycheff Inequality Method

A Tchebycheff Inequality Method sensitivity analysis is included beginning in **Rows 61 - 77**. The analysis automatically calculates when the **<Ctrl> <Q>** macro is run above. The Tchebycheff analysis is a statistical method for estimating upper and lower confidence levels given uncertainty in multiple variables. It assumes the uncertain variables are uncorrelated and vary according to a normal distribution. In this case, the Tchebycheff analysis uses the uncertainty ranges input in rows 9- 36 to determine a 90% upper and lower bound for the total status quo costs. These bounds are shown **in Cells D75 and D76** respectively. These results are plotted on the Cuml PV chart described below.

Charts

The CEA model generates several charts. No additional inputs are required to generate these charts. The charts graphically show the results of the sensitivity analysis. Therefore it is necessary to rerun the sensitivity analysis each time results are changed before viewing these charts.

There is a tab for each chart. The tab titles and associated content are as follows:

Tab Title	Content
Cuml PV	Cumulative Present Value and Upper and Lower Bounds of Status Quo and Cumulative Present Value of Privatization Alternative for the Selected Analysis Period
Cuml RR	Cumulative Present Value of Infrastructure Costs (R&R + Capital Projects) for Status Quo and Privatization Alternative for the Selected Analysis Period
Sen Discount	Present Value of Status Quo and Privatization Alternative Based on a Range of Discount Rate Values
Sen O&M	Present Value of Status Quo and Privatization Alternative Based on a Range of O&M Costs for the Status Quo
Sen G&A	Present Value of Status Quo and Privatization Alternative Based on a Range of General and Administrative Costs for the Status Quo
Sen Additional AF	Present Value of Status Quo and Privatization Alternative Based on a Range of Values of Privatization Costs in Addition to Costs Paid to the Privatization Contractor
Sen R&R	Present Value of Status Quo and Privatization Alternative Based on a Range of Renewal and Replacement Costs
Sen FedTax	Present Value of Status Quo and Privatization Alternative Based on a Range of Federal Tax Implicitly Included in Payments the Air Force Would Make Under the Offeror's Bid

Appendix A

Utilities Privatization Database Overview

Purpose

The purpose of this Utilities Privatization Database is to provide a consistent data source for the Air Force as it evaluates the proposals received during Phase III of the Utilities Privatization program. Having a database that can be used by all evaluators allows for consistent costing in all situations. This database should be used by government evaluators to generate government cost estimates. These estimates will then be used to compare pricing to the bids received from prospective contractors. Finally, this information will be used in the Certified Economic Analysis.

Database Content

The database contains line item cost information for *Electric, Water*, and *Natural Gas* distribution systems and *Wastewater* collection systems. Each line item contains the following information:

Database Field	Field Description
1	Index Number
2	System
3	Subsystem
4	Item Number
5	Data Source
6	Component Description
7	Unit of Measure (UOM)
8	Total Unit Cost
9	Design Life
10	Replacement Cost Factor
11	Replacement Cost

Area Cost Factor Adjustment Information supplied in this database must be adjusted for location*Area Cost Factors* are provided to adjust costs to specific locations. These factors should come from the latest "*Historical Air Force Construction Cost Handbook*" available on the HQ AFCESA Web Site at http://www.afcesa.af.mil/userdocuments/publications/AFpublications/ces/cesc/Histbook_Feb_04.pdf Area cost factors take into consideration the cost of construction materials, labor and equipment, and other factors such as weather, climate, seismic conditions, mobilization, overhead and profit, labor availability, and labor productivity for each area.

Types of Costs

Greenfield Construction Costs

The new, Greenfield, construction costs presented in this database represent the installing contractor costs plus an allowance for overhead and profit. No special considerations have been made for work done under roads or in or under buildings. The user, depending on the special situations they encounter must include these costs. New construction costs were primarily derived from R.S. Means CostWorks 2000, Paces 2000 models, and the Commercial Unit Price Book (CUPB) for year 2000 and escalated to 2001 using the inflation indices from Tab "T2b- Inf Index" of the model.

Replacement Construction Costs

The replacement construction costs are a function of the new construction costs with an applicable adjustment factor added. The factor takes into consideration such costs as removing and disposing of the old component. As a general rule, replacement costs is greater than new construction costs since removal and disposal of old equipment must be accounted for versus green field construction.

In many cases, materials identified for replacement will not be the same as the originally installed materials since many of those materials are no longer recommended in standard industry due to technological advances or better construction practices. For example, 50-year old steel piping in a natural gas system may be replaced with PE piping. If this is done, the estimator should choose the cost of PE pipe and not new steel piping.

Trenching Costs

With the exception of electrical ductbanks, trenching, bedding, backfill and compaction costs are not included in the cost line items. The database contains separate line items for these costs based upon soil type and depth of trenching. These line items need to be added in separately when estimating new or replacement piping system costs.

Pavement Cut Costs

All or part of the electric, gas, water, or wastewater system may cross or be under a roadway, parking lot, sidewalk, etc. As such, the cost of pavement cuts must be added to the replacement cost of the utility system. The Unit Cost Database includes the cost of removing and replacing pavements on a per linear foot (LF) basis.

The most efficient method for incorporating the cost of pavement cuts into the estimate is as follows:

1. Determine the approximate percentage of the utility that is beneath a pavement.
2. Multiply the appropriate pavement removal and replacement cost by the approximate percentage.
3. Add the product of 2 above to the replacement trenching cost in Column Q of the T4-Inventory for the line item.

Excavation Costs

Manholes, Handholes, Vaults, & Valves require excavation, backfill, and compaction costs associated with their installation. The Unit Cost Database, in Trenching, Backfill, and Compaction, includes the per Cubic Yard (CY) costs for different soils and varying depths. Appendix B provides Excel Spreadsheets that can be used to calculate the amount of excavation required. The most efficient method for incorporating the cost of excavation into the estimate is as follows:

1. Determine the appropriate Unit Cost Database line item based upon the soil conditions and depth of excavation. Enter the line item number in Columns G and K of the T4-Inventory.
2. Using the tables provided in Appendix B, determine both the New/Original quantity and the Replacement Quantity for the excavation.
3. For Existing, add to the Logic Statement in Column N *New/Original quantity, e.g.,

   IF($G24>0, LOOKUP($G24,'Unit Cost'!$A$4:$A$1503,'Unit Cost'!$H$4:$H$1503), 0)*New/Original Quantity.

4. For Replacement, add to the Logic Statement in Column Q *Replacement quantity, e.g.,

   IF($K24>0, LOOKUP($K24,'Unit Cost'!$A$4:$A$1503,'Unit Cost'!$H$4:$H$1503), 0)*Replacement Quantity.

Examples of Calculating New and Replacement Costs

The following 2 examples show how ***New*** *and* ***Replacement*** costs are calculated by the model using the Utilities Privatization Database.

For these examples, we want to calculate the *New* and *Replacement* costs for 1000' of overhead power line. Thirty-five foot tall wood poles will be used. They will be spaced every 250'. The poles will include 6' long cross arms. There will be 3 conductors on each pole. The poles are located at Tyndall Air Force Base in Panama City, Florida. We want our results in year 2002 dollars.

Proprietary data removed

Proprietary data removed

Appendix B

Excavation and Backfill Calculations

MANHOLE AND WET WELL CALCULATIONS

V=3.14h/3((r1^2)+(r1*r2)+(r2^2))

New and Original Construction:

Diameter	Sand/Sand Gravel & Saturated Soil — Depth in Feet				
	6	8	10	12	0
4	51	84	130	189	0
5	57	94	143	206	0
6	65	104	156	224	0
0	0	0	0	0	0

Diameter	All Other Soils Except Rock — Depth in Feet				
	6	8	10	12	0
4	22	41	69	108	0
5	26	47	78	121	0
6	31	55	88	134	0
0	0	0	0	0	0

Diameter	Ro… — De…	
	6	8
4	6	8
5	9	11
6	11	15
0	0	0

Replacement Construction:

Diameter	Sand/Sand Gravel & Saturated Soil — Depth in Feet				
	6	8	10	12	0
4	48	80	125	184	0
5	53	88	135	197	0
6	58	96	146	211	0
0	0	0	0	0	0

Diameter	All Other Soils Except Rock — Depth in Feet				
	6	8	10	12	0
4	19	37	64	103	0
5	22	42	71	112	0
6	25	46	78	121	0
0	0	0	0	0	0

Diameter	Roc… — De…	
	6	8
4	3	5
5	4	6
6	5	7
0	0	0

* Material Removed
Calculations are

For other depths and diameters, insert sizes in [ ] for quick answers.

NOTES:
1. Depth includes 2' overcut to allow for gravel bed and concrete bottom and accounts for the hollow core of the
2. Diameters are in Feet; Volume is in Cubic Yards.
3. Even when the soil conditions allow "vertical digging," the safety standards preclude this for manholes as a g
   In very stable soils, excavation can be a truncated cone inverted on a 3 or 4' high cylinder.

Handholes

V = (3.14*((Diagonal+2)/2)^2)*(h)

New and Original Construction:

Length (FT)	Width (FT)	Height (FT)
1	2	1.75
4.5	3.2	2

Sand/SandGravel & Saturated Soil
1
5
0

All Other Soils Except Rock
1
5
0

Rock
1
5
0

Vaults

V=3.14h/3((r1^2)+(r1*r2)+(r2^2))

New and Original Construction:

Length	Width	Height	Depth	Sand/SandGravel & Saturated Soil	All Other Soils Except Rock	Rock
4	6	6	2	74	36	14
5	10	6	2	109	59	25
5	12	6	2	128	70	29
6	10	6	2	114	63	28
6	12	6	2	132	74	33
6	13	6	2	143	81	36
8	14	7	2	200	121	53
0	0	0	0	0	0	0

Replacement Construction:

Length	Width	Height	Depth	Sand/SandGravel & Saturated Soil	All Other Soils Except Rock	Rock *
4	6	6	2	69	31	9
5	10	6	2	98	47	14
5	12	6	2	115	57	16
6	10	6	2	101	49	15
6	12	6	2	116	58	17
6	13	6	2	125	63	18
8	14	7	2	171	92	24
0	0	0	0	0	0	0

* Material Removed will be normal soil.
Calculations are for volume only.

For other depths and diameters, insert sizes in ____ for quick answers.

NOTES:
1. Depth includes 2' overcut to allow for gravel bed.
2. Volume is in Cubic Yards.

Valves

V=3.14h/3((r1^2)+(r1*r2)+(r2^2))

New, Original, and Replacement Construction:

		All Soils Except Rock						Valve Size		Rock *				
		Depth in Feet								Depth in Feet				
		3	6	8	12	0				3	6	8	12	0
Diameter	2	1.9	3.3	4.2	6.0	0.0	<-------	1" - 4"	------->	0.5	0.8	1.0	1.5	0.0
	4	4.2	7.3	9.4	13.6	0.0	<-------	6" - 12"	------->	1.9	3.3	4.2	6.0	0.0
	6	7.4	13.0	16.7	24.2	0.0	<-------	14" - 24"	------->	4.2	7.3	9.4	13.6	0.0
	8	11.6	20.4	26.2	37.8	0.0	<-------	30" - 36"	------->	7.4	13.0	16.7	24.2	0.0

* Material Removed for Replacement will be normal soil.

For other depths and diameters, insert sizes in ____ for quick answers.

NOTES:
1. Depth includes 1' overcut to allow for gravel bed.
2. Diameters are in Feet; Volume is in Cubic Yards.

Vaults

V=3.14h/3((r1^2)+(r1*r2)+(r2^2))

New and Original Construction:

Length	Width	Height	Depth	Sand/SandGravel & Saturated Soil	All Other Soils Except Rock	Rock
4	6	6	2	74	36	14
5	10	6	2	109	59	25
5	12	6	2	128	70	29
6	10	6	2	114	63	28
6	12	6	2	132	74	33
6	13	6	2	143	81	36
8	14	7	2	200	121	53
0	0	0	0	0	0	0

Replacement Construction:

Length	Width	Height	Depth	Sand/SandGravel & Saturated Soil	All Other Soils Except Rock	Rock *
4	6	6	2	69	31	9
5	10	6	2	98	47	14
5	12	6	2	115	57	16
6	10	6	2	101	49	15
6	12	6	2	116	58	17
6	13	6	2	125	63	18
8	14	7	2	171	92	24
0	0	0	0	0	0	0

* Material Removed will be normal soil.
Calculations are for volume only.

For other depths and diameters, insert sizes in ____ for quick answers.

NOTES:
1. Depth includes 2' overcut to allow for gravel bed.
2. Volume is in Cubic Yards.

Valves

V=3.14h/3((r1^2)+(r1*r2)+(r2^2))

New, Original, and Replacement Construction:

		All Soils Except Rock						Valve Size		Rock *				
		Depth in Feet								Depth in Feet				
		3	6	8	12	0				3	6	8	12	0
Diameter	2	1.9	3.3	4.2	6.0	0.0	<-------	1" - 4"	------->	0.5	0.8	1.0	1.5	0.0
	4	4.2	7.3	9.4	13.6	0.0	<-------	6" - 12"	------->	1.9	3.3	4.2	6.0	0.0
	6	7.4	13.0	16.7	24.2	0.0	<-------	14" - 24"	------->	4.2	7.3	9.4	13.6	0.0
	8	11.6	20.4	26.2	37.8	0.0	<-------	30" - 36"	------->	7.4	13.0	16.7	24.2	0.0

* Material Removed for Replacement will be normal soil.

For other depths and diameters, insert sizes in ____ for quick answers.

NOTES:
1. Depth includes 1' overcut to allow for gravel bed.
2. Diameters are in Feet; Volume is in Cubic Yards.

Appendix C

Proprietary data removed

Appendix D

Proprietary data removed

Appendix E

Proprietary data removed

Appendix F

Proprietary data removed